

WHAT IS CLAIMED IS:

- 1 1. A fluorescence spectrophotometer system including:
 - 2 (a) a light source;
 - 3 (b) a first double monochromator operating to separate and output selected
4 wavelengths of light from the light source as excitation light;
 - 5 (c) a reflection light transfer module for directing substantially all of the
6 excitation light directly onto a sample, and for collecting, focusing, and
7 directing fluorescence light emitted from the sample as emission light;
 - 8 (d) a second double monochromator operating to separate and output selected
9 wavelengths of the emission light; and
 - 10 (e) a photodetector and analyzer for detecting the selected wavelengths of
11 emission light and outputting an indication of such detection.

- 1 2. The fluorescence spectrophotometer system of claim 1, wherein the first double
2 monochromator or the second double monochromator includes:
 - 3 (a) an entrance slit for accepting light;
 - 4 (b) a first optical grating positioned to intercept and disperse the accepted light
5 from the entrance slit;
 - 6 (c) a first selection slit positioned to intercept at least part of the dispersed light
7 from the first optical grating and select and pass a narrowed range of
8 wavelengths from such dispersed light;
 - 9 (d) a second optical grating positioned to intercept and disperse the passed light
10 from the first selection slit; and
 - 11 (e) a second selection slit positioned to intercept at least part of the dispersed light
12 from the second optical grating and select and pass a narrowed range of
13 wavelengths from such dispersed light.

- 1 3. The fluorescence spectrophotometer system of claim 2, wherein the first optical
2 grating and the second optical grating are both concave gratings.

- 1 4. The fluorescence spectrophotometer system of claim 3, wherein the concave gratings
2 are holographic concave gratings.

- 1 5. The fluorescence spectrophotometer system of claim 2, wherein the first optical
2 grating and the second optical grating pivot about axes of rotation for selecting a
3 desired range of wavelengths of light as a function of angle of rotation.
- 1 6. The fluorescence spectrophotometer system of claim 2, further including a band
2 drive, coupled to each of the first optical grating and the second optical grating, for
3 rotating the first optical grating and the second optical grating synchronously.
- 1 7. The fluorescence spectrophotometer system of claim 1, wherein the reflection light
2 transfer module includes:
3 (a) an excitation mirror, positioned substantially coaxial with a well containing
4 the sample, for directing excitation light to illuminate the sample; and
5 (b) an emission mirror, positioned substantially coaxial with the well containing
6 the sample, for collecting, focusing, and directing fluorescence light emitted
7 by the sample.
- 1 8. The fluorescence spectrophotometer system of claim 7, wherein the emission mirror
2 is a spherical mirror.
- 1 9. The fluorescence spectrophotometer system of claim 7, wherein the excitation and
2 emission mirrors are first-surface mirrors.
- 1 10. The fluorescence spectrophotometer system of claim 7, wherein the excitation mirror
2 is positioned to direct excitation light into an opening of the well, and the emission
3 mirror is positioned to collect fluorescence light emitted from the opening of the well.
- 1 11. The fluorescence spectrophotometer system of claim 7, wherein the well has a
2 transparent bottom substrate, and the excitation mirror is positioned to direct
3 excitation light into the well through the transparent bottom substrate, and the
4 emission mirror is positioned to collect fluorescence light emitted from a top opening
5 of the well.

- 1 12. The fluorescence spectrophotometer system of claim 11, wherein one or both of the
2 light source and first double monochromator are moved to direct excitation light
3 directly onto the excitation mirror.
- 1 13. The fluorescence spectrophotometer system of claim 11, wherein one or more light
2 directing mirrors are positioned to direct excitation light from the first double
3 monochromator to the excitation mirror.
- 1 14. The fluorescence spectrophotometer system of claim 1, wherein the photodetector
2 and analyzer counts the number of photons of the detected selected wavelengths of
3 emission light.
- 1 15. A double monochromator including:
2 (a) an entrance slit for accepting light;
3 (b) a first optical grating positioned to intercept and disperse the accepted light
4 from the entrance slit;
5 (c) a first selection slit positioned to intercept at least part of the dispersed light
6 from the first optical grating and select and pass a narrowed range of
7 wavelengths from such dispersed light;
8 (d) a second optical grating positioned to intercept and disperse the passed light
9 from the first selection slit; and
10 (e) a second selection slit positioned to intercept at least part of the dispersed light
11 from the second optical grating and select and pass a narrowed range of
12 wavelengths from such dispersed light.
- 1 16. The double monochromator of claim 15, wherein the first optical grating and the
2 second optical grating are both concave gratings.
- 1 17. The double monochromator of claim 16, wherein the concave gratings are
2 holographic concave gratings.

- 1 18. The double monochromator of claim 15, wherein the first optical grating and the
2 second optical grating pivot about axes of rotation for selecting a desired range of
3 wavelengths of light as a function of angle of rotation.
- 1 19. The double monochromator of claim 15, further including a band drive, coupled to
2 each of the first optical grating and the second optical grating, for rotating the first
3 optical grating and the second optical grating synchronously.
- 1 20. A reflection light transfer module including:
2 (a) an input mirror, positioned substantially coaxial with an area to be
3 illuminated, for directing incoming light to illuminate the area; and
4 (b) an output mirror, positioned substantially coaxial with the area to be
5 illuminated and in reflective alignment with the input mirror, for collecting,
6 focusing, and directing light emitted by the area upon illumination.
- 1 21. The reflection light transfer module of claim 20, wherein the emission mirror is a
2 spherical mirror.
- 1 22. The reflection light transfer module of claim 20, wherein the excitation and emission
2 mirrors are first-surface mirrors.